Class.	Description of explosive.	Number of experiments (each experiment involving two explosions and time measurements).	Velocity found in metres per second.	Temperature C.	Velocity of sound calculated in metres per second.	Excess of velocity as compared with velocity of sound.
						per cent.
A	9 oz. dry guncotton.	11	1732±22	17°·8	1523	13·75
B	10 oz. No. 1 dynamite	24	1775±27	14·5	1508	17·7
C	18 oz. dry guncotton.	5	1942±8	18·3	1525	27·3
D	64 oz. dry guncotton.	3	2013±35	19·0	1528	31·7

The chief portion of the paper is occupied by a description of the details of the precautions taken to make the measurements as accurate as possible.

II. "An Experimental Investigation of the Circumstances under which a Change of the Velocity in the Propagation of the Ignition of an Explosive Gaseous Mixture takes place in closed and open Vessels. Part I. Chronographic Measurements." By FREDERICK J. SMITH, M.A., Millard Lecturer, Exptl. Mech., Trin. Coll., Oxford. Communicated by A. G. VERNON HARCOURT, F.R.S. Received March 12, 1889.

(Abstract.)

The subject of the paper of which this is an abstract, is the determination of the rate of change of the velocity of the propagation of an explosion in gaseous explosive mixtures.

It has been noticed by several investigators, viz., MM. Berthelot and Vielle, MM. Mallard and Le Chatelier, and Professor H. B. Dixon, F.R.S., that explosive gaseous mixtures after ignition do not reach their maximum velocity of propagation at once, but that a certain maximum velocity is attained soon after initial ignition.

In order to investigate this interesting period, which may be called the acceleration period of an explosion, chronographic measurements of a peculiar nature were found necessary.

It was at once evident that but little advance in this branch of the subject of explosions could be made unless exceedingly minute periods of time could be measured with certainty.

It was not possible to work with the pendulum chronograph (good as this instrument is for other branches of research), as its length of traverse is too limited, and the difficulty of subdividing tuning fork traces is found to be very great, since the velocity of the pendulum varies from zero up to a maximum during its swing; this being so, a new form of chronograph has been devised to meet as far as possible all the requirements of the case, by means of the instrument. The following results have been obtained:—

1. The $\frac{1}{20000}$th second can be measured with ease, and periods of time differing from $\frac{1}{10}$th second to $\frac{1}{20000}$th second can be recorded on the same moving surface.

2. The surface which receives the record moves at a velocity which is practically constant during the traverse of 50 cm.; also its velocity can be varied between wide limits.

3. A large number of time records can be made side by side, all records being made in straight lines.

4. Fractions of recorded vibrations of a fork can be subdivided by means of a micrometer microscope. This is not the case with vibrations recorded on a surface attached to a pendulum, where the velocity varies from zero up to a maximum at the middle of the swing.

The electromagnetic styli, by means of which events are marked, are so constructed that their period of "latency" is almost absolutely constant, and their electromagnets are so wound that no sparking takes place on breaking the circuit.

A moving surface is carried on a carriage, which is propelled by means of a falling weight, which after a certain velocity has been attained is removed, the surface then moves with a velocity which is found to be practically constant, for the limits between which a time record is made.

The chronograph is used in conjunction with a steel tube in which the explosions take place. At even distances along the axis of the tube, conducting bridges, eight to ten in number, of Dutch metal insulated from the tube, are placed; each bridge is connected electrically with a recording stylus, so that as each bridge is broken by the explosion, a mark is made on the surface of the chronograph; these markings when duly interpreted provide data for constructing a curve, which indicates the rate at which the velocity of the explosion is changing during its propagation.

The rest of the paper treats of the methods by means of which the errors due to the use of electromagnets in chronographic work have been dealt with and reduced as far as possible.